FEASIBILITY REPORT

A feasibility report, as discussed in Chapter One, is prepared to present an in-depth techno-commercial analysis carried out on the project idea for consideration of the financial institutions and other authorities empowered to take the investment decision. According to the guidelines published by the Planning Commission a feasibility report should include:

1. Raw material survey
2. Demand study
3. Technical study
   - Product pattern
   - Process selection
   - Plant size
   - Raw material requirements
4. Location study
5. Project capital cost estimates and source of finance
6. Profitability and cash flow analysis
7. Cost benefit analysis

We will scan through the contents of a feasibility report in some detail to enable us to uptake the same.

Raw Material Survey

The raw materials may belong to any of the following categories:

1. Available in natural form as deposit, either on the surface or underground, in one part or different parts of the country. Necessary arrangements in that case are to be made for extracting the same from the main raw material body and transport it to the processing centre. Studies would look into not only the quality of the raw material to assess its suitability for the manufacturing process, but also the quantity to decide on the size and life of the plant it would support. The study would also take into consideration the quantity of material already committed for different plants in operation or in the pipeline.

2. Available as finished product or by-product from some operating plants or likely to be available in the near future from some plant or plants under construction.

Studies establish availability of raw material as per grade and quantity required. Usually, the survey would be made through desk study of available reports or through questionnaires issued to the companies manufacturing or installing facilities to manufacture the product/by-products which will be used as feed to the proposed plant.

3. Not available in the country but to be imported. This could either be in natural form or as finished product or by-product of some existing plants. The survey would again be made through desk study of literature available from different foreign trade missions followed by questionnaires issued to various companies known to supply or manufacture these materials.

A new investigation to establish availability of raw materials is normally needed, but in cases where there is considerable delay in establishing the project, it may be necessary to obtain reconfirmation of the availability from the companies supplying or producing them.

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Demand Study

A demand study normally would establish the following:

1. *Demand* Covering uses of the product proposed to be manufactured, the prospective consumers, present consumption, expected consumption in future including possibility of exports.
2. *Supply* Covering assessment of existing capacity, present level of production, capacity utilization, extent of import and projected supply considering the plants under construction.
3. *Distribution* Covering channels of distribution, mode of transport, mode of packing and cost of distribution, Government policies, etc.
4. *Prices* Covering both domestic and international price trends, control on price as imposed by the Government, prevailing duties and taxes.

Most of the information is available from published literature. In special cases, however, an independent survey may be needed. Some of the documents that are usually referred to for this purpose are as follows:

1. *Plan documents* Issued by the Planning Commission, provides information on plan proposals and growth targets that are both physical and fiscal.
2. *Guidelines to industries* Published by the Department of Industrial Development, Ministry of Industry. It provides information about licensed and installed capacity, present production, imports and exports, indigenous capability regarding knowhow, design and fabrication, future scope, etc.
3. *Economic survey* Published by the Ministry of Finance, it provides data on industrial production, prices, exports, etc.
4. *Annual survey of industries* Published by the Central Statistical Organisation, it provides data on production, number of units installed, capacity, etc. for several industries.
5. *Import and export statistics* Published by the Ministry of Commerce, it provides data on imports and exports of a very large number of items.
6. *Monthly bulletin of Reserve Bank of India* Provides information on production and cost indices for various industrial items.
7. *Survey reports of various institutions* Publications of the Industrial Development Bank of India, National Council of Applied Economic Research, Times of India Economic Division, etc. These documents provide information relating to production, consumption, import, export and prices.

Various market research agencies are available which can analyze the published information and also carry out field surveys to collect realistic information regarding demand, supply and prices. Normally, a field survey is carried out to confirm some of the conclusions of the desk study. Such studies are usually referred to as *sample surveys*. Accuracy and dependability of such surveys depends upon a number of factors not excluding the capability of the surveyor and willingness of the respondents to part with authentic information.

Long-range sales forecasts or projections over the possible life-span of the plant, are essential to work out the sales revenue for the project. These forecasts may prove to be wrong

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due to various external factors, assuming that in the first instance the forecasts were competently made. Thus, it may become necessary to take another look at these forecasts in case there has been a long time gap between the completion of feasibility study and the effective starting date of the project. Since demand study is a time-consuming affair, a restudy is avoided unless there has been an abnormal change in the environment.

Technical Study

Product Pattern The demand survey projects an estimate of potential sales and the raw material survey confirms if adequate material will be available to support the project. These two data and a consideration of economy of scale should be sufficient to select the plant capacity. But a final decision in this regard can be made only after the financial resources required and the available alternative technologies are also evaluated. In the case of a process plant, the selected process would also determine the various co-products and by-products that are possible. In such cases, quantities of all such products have to be established. In some cases, by utilizing the by-products, a further set of products can be obtained. The total spectrum of products—co-products and by-products—represents what is known as the *product pattern.*

Besides market and technology, there are other factors which may affect the decision regarding plant capacity. Technology may dictate the minimum scale of operation, but economy of scale and resource requirement may sway the decision from one capacity level to another. Also, if the technology is likely to change very fast, as it is in the case of electronics, the choice may fall on a smaller plant capacity. Governmental controls in terms of prices, tax reliefs, import and export may also determine the plant capacity and the product pattern. It is unlikely that the optimum of plant capacity selected during feasibility study will change by the time the project reaches the zero date. If, however, the time elapsed is very large, a re-study may be required to establish all over again the product pattern and optimal plant capacity.

Process Selection The product pattern so selected and the raw material availability will govern the selection of the processing scheme. But detailed evaluation including the economics of operation of alternative processing schemes is necessary for selecting an optimum process. Usually a processing scheme is developed by an operating company through its own R and D effort and is protected by patents. The company is then said to possess *know-how.* If the company agrees to share this know-how with others, it may be done through a technology licence agreement. The mode of technology transfer will depend on the capability of the receiving party. Unless the company possessing the know-how also engineers projects, the same may be passed on to a project engineering company through a technology licence agreement. The project engineering company will then convert the know-how into a technological package and market it. Normally, a good technology package for a chemical process plant should consist of:

1. Basic design data, process description and specification
2. Process flow diagram
3. Equipment list
4. Process data sheets for all equipments

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5. Process piping and instrumentation diagrams (P and I)
6. Instrument data sheets
7. Utility summary
8. Indicative plot plan
9. Utility P and I
10. Pipeline list—process and utility
11. Operating instructions

The technology package is not always so complete. At times it is quite sketchy requiring substantial work by the detailed engineers and before it becomes convertible into detailed engineering documents. If this expertise is not available with the recipient party, it will be necessary to specify the contents of the package to avoid delays in the effective start of a project. But till the technology package is ready, a project cannot be considered to have been established.

A complete technology package is not available, nor is it required for evaluation of alternative processing schemes. During the feasibility study period, the investigation is made regarding the sources of know-how and contact is established with them for obtaining the data necessary for the evaluation of alternative processing schemes and establishment of capital cost estimate. From this contact only limited information is likely to be available. The various factors that could result in a meaningful evaluation are:

1. Indigenous v. foreign know-how
2. Type of process and stage of development
3. Raw material requirements
4. Utilities requirement
5. Indigenous and foreign component requirement
6. Flexibility in product pattern and compliance with Indian market requirements
7. Operating cost and installed capitals cost
8. Economic analysis
9. Organizational ability of process licensor
10. Success of the process in the country of origin and in other countries where it has been licensed.

Suitable weightage can be assigned to each of the above factors for deciding on a particular process. Some of the factors which may weigh heavily are:

1. Size of investment
2. Limitation of foreign exchange
3. Limitation of power
4. Disposal of by-products and effluents

If the process is openly available, then detailed information can be obtained even at the feasibility study stage. If the know-how is available with the owner, then this step, i.e., evaluation of process, can altogether be eliminated. What would still be required is development of a comprehensive technology package which alone can define the technical configuration of the project and its battery limit conditions. If the know-how is not available with the owner, it has to be obtained under a licence agreement which covers the supply of know-how, basic engineering and process guarantees. This package will be converted into detailed plant design by a detailed engineering contractor.

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Where necessary resources do not exist for translating process technology into an operating plant, the owner may enter into a turnkey contract. The turnkey contractor may be either the owner of technology, or the main supplier of machinery or a consulting engineering firm. A project, in such cases, can be considered to have been established only when that contract is signed.

Location Study

To meet their targets relating to time and cost, it is necessary that the site has been properly selected and possession taken of before the zero date. Normally, the financial institutions will depute a team of experts to inspect the site before they sanction any loan. Uncertainties associated with the site and particularly that of sub-soil conditions must also be removed before the zero date. If the plant site has to be relocated at a later date, not only will the targets be missed but even the viability of the project may also be lost.

Project sites are selected on several considerations. The basic considerations are:

1. Availability of land, soil characteristics and cost of the land
2. Approach to site
3. Source of raw material and transportation requirement
4. Transportation and marketing of finished product
5. Source and availability of water
6. Availability of power and source
7. Availability of skilled manpower
8. Social amenities in the area
9. Availability of tax incentives, if any
10. Facilities for drainage and effluent disposal
11. Availability of engineering and maintenance facilities
12. Acceptance of the project by the local bodies

Individually each of the factors will have to be considered for the selection of a site by giving due weightage to each one of them depending on their importance. We shall discuss this process of selection in some detail so as to make sure that all the issues are taken care of before siting a project.

Availability of Land The site chosen should be sufficiently large for the present requirement and also for any possible future expansion. Once the processing scheme is finalized, the area required for accommodating the plant and machinery is usually decided by developing a layout. The size of the actual manufacturing unit with allowances for utilities and off-site facilities, arterial roads, car parks and open spaces, would normally determine the minimum requirement of space for the project. The actual space to be acquired will depend on local circumstances. Unless the plant is sited in urban districts, the cost of land will form a small percentage of the total project cost and, therefore, the area to be acquired should be estimated on the generous side to take care of townships and future expansion of process units and off-site facilities.

Land should preferably be government-owned and available for industrial development. It should not involve displacement of population. The land should be reasonably flat so that expensive levelling can be avoided. It should have adequate means of natural or artificial

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drainage. The site should not get flooded from river water or sea tides. It should also be accessible for transport of materials and personnel with right of access through properties not owned by company.

The land should be suitable for heavy construction work and not subject to subsidence or earthquakes of significant magnitude. The load-bearing capacity of the land should be ascertained if the equipment and machinery to be erected are heavy. However, if the plant does not have heavy machinery, the soil data available for the neighbouring area may serve the purpose.

Ultimately, the price to be paid should be competitive with other suitable sites. Unless all the factors are considered, low price quoted by a landowner may prove misleading.

Approach to Site The site must be approachable by rail or road. Nearness of the railway siding and national highway are major considerations. One helpful tool in this regard is a regional map showing railroads and highways. The location of possible suppliers of raw materials, plant and machinery and target market for the finished products can be marked on the map. Once all the related information is put on the map, the ease of approaching the site by all concerned can be easily ascertained.

Transportation The cost or difficulty of transportation is one of the most important factors in the selection of a site. Where the quantity of raw material to be handled is several times that of the product, a site nearer to the source of raw material may be selected. Cement plants, for example, are located near the source of the main raw material—limestone. If the quality of raw material is likely to deteriorate in transportation, then it is preferred to locate the plant near the source of raw material.

The economic mode of transport is related to the volume and nature of the raw materials and products to be handled. Naturally, choice will be in favour of the site which has ready access to the most economic mode of transport. It may be necessary to develop rail connections with the site, construct roads and bridges, develop harbours, lay pipelines or construct aerial ropeways to make the most cost-effective transportation available.

Besides transportation of raw material and finished product, consideration has also to be given to the transportation of plant operating staff. Staff colonies have to be considered where transporting staff from nearby town is not feasible. The cost of the township will have to be reckoned with while selecting a site.

Water There are certain industries where consumption of water is very high. In such cases the selection of the site will be governed by availability of water. Cost of pumping water to site and its treatment will always influence the selection of a project site. Sea water is rarely suitable for process use and the cost of using it for cooling purposes is very high. If it is required to depend on sub-soil water, yield should be ascertained through detailed investigation. Unless it is proved that sub soil water can meet plant requirement over its entire life, the site cannot be accepted for locating the plant. Local water courses and fresh water lakes may be dependable sources but the right to pump water from such sources has to be fully established before a site is chosen.

Ultimately it is the cost of obtaining water of desired quality which will influence the selection of the site. Initially, an assessment of the quantity and quality of water will be

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required to be made for this purpose. Such an assessment should take into consideration water required for the process steam raising, cooling water make-up, floor washing, fire-fighting and drinking purposes. Potable water may be available from the local supply, but if the requirement is large the cost will be exorbitant and it will be necessary to look for alternative sources. Even if it is available from a nearby municipality, the quality of water and its availability round the year must be ascertained before selecting the site.

Power Power may be the only guiding factor for plant location for some industries like aluminium, mini-steel, calcium carbide, etc. Power for many such industries is considered as raw material and as such all the requirements in the case of raw material will also apply here. Where power supply from power grid is not regular or not available as required, it would be necessary to consider a captive power generation plant. This will, of course, mean additional capital investment. But a continuous process requires uninterrupted power supply; irregular power will not only cause heavy losses but may also damage plant machinery and equipment. It is essential in such cases to maintain a stand-by power generation system, again adding to the capital cost of the project.

India is currently experiencing power shortage. Therefore, there is hardly any choice in this respect since almost all the states are facing power shortage. The solution, it appears, lies in the selection of energy-saving processes and keeping stand-by generation systems for critical process equipment. Creation of adequate intraprocess storage to meet the uncertainties of power supply is yet another consideration for the development of plant processing systems.

Even where the power supply is from the state power grid, studies need to be carried out to select the most economic system regarding supply voltage, nearness of distribution centre, tariff, etc. The various system parameters will affect the cost of the receiving system as also the reliability of power supply. Obviously, the site which will involve least capital cost, recurring tariff and uncertainty of supply would be the choice as far as power is concerned.

Manpower In a country ridden with a chronic unemployment problem, manpower should not be a major constraint. But it is indeed a paradox that one faces scarcity of skilled manpower amidst plenty of unemployed people. What the industry needs is manpower of desired skill and that is not easily available. The problem becomes more aggravated if the project is located at a remote place. In such a situation, it is difficult to attract skilled manpower from other centres of employment. Provision has to be made to train local people. Also, increased amenities like housing and other perquisites will have to be provided to attract people from outside if requisite skill or expertise cannot be obtained locally. This would also add to project cost.

Also, cost of labour in different parts of the country is not the same. However, it would be misleading to take present labour cost as the criteria for selection of a site as the same may undergo drastic changes at a later date due to industrialization in the area. What needs to be given consideration in the selection of a site is the added cost that may be involved in recruiting people, providing housing or transportation and training them.

The review of manpower should also take into consideration labour relation, productivity, etc. in a particular region. These are, of course, not permanent factors, as industries can build their own work culture conducive to harmonious work relationship and higher productivity.

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Regional Development If industries are set up in notified backward areas, then certain benefits are available by way of low cost of land, cash subsidy, development loan and tax relief. All the state industrial development corporations are vying with each other to attract industries in socially and economically backward areas with lucrative benefit packages. Besides the economic benefit packages, the projects in some cases may also have the benefit of ready infrastructure normally required for any industrial project. The financial institutions may also provide assistance at concessional rates and relax their norms regarding debt-equity ratio, promotor's contribution, repayment period, etc. The benefits so available will have to weigh against the odds the project is likely to face in terms of other factors which need to be considered for the selection of a site. If raw materials, power and other inputs are easily available and there is not too much of a problem in marketing the produce, then locating the project in a backward area may be an attractive proposition.

Effluent Disposal Effluents may be solid, liquid, gaseous or a combination of all three. The selection of the site is not so influenced by gaseous effluents as they are to be discharged in to the atmosphere after necessary treatment meeting the pollution control board's requirements. However, it is another matter that the pollution control board's guidelines have, of late, become very stringent and plants with hazardous emissions will require sophisticated controls.

The problems, however, exist with solid and liquid effluents. In case of solid effluents a suitable location must be available for dumping the material within a reasonable distance from the project site. The problem assumes great importance particularly in case of metallurgical projects. If the dumping space is limited, a new location has to be found. The volume and nature of the effluent will influence the location of the dumping space or provisions to be made for prevention of hazards to the environment.

For liquid effluents the problem is even greater. Gone are the days when all liquid effluents could be discharged without treatment in to a 'nullah' or natural waterways. These days the effluent has to be harmless or otherwise it will not be permitted for discharge into natural waterways. If the cost of treatment is very high, the only alternative may be to select a site in the coastal region so that the effluent may be discharged in to the sea without any treatment. In all other cases the pumping cost for disposal will have to be given due consideration in addition to the treatment cost in the selection of a site.

Acceptability of Local Bodies Besides adherence to pollution norms, there are many other stipulations which must be adhered to for putting up a project at a particular site. The agencies whose consents are required or which are to be consulted would depend on the type of project. Some state governments these days are providing these clearances through a single window, but where this service is not available obtaining such clearances could be a frustrating experience and may take considerable time. Many state planning bodies have drawn up master plans earmarking areas for various types of industrial projects. In such cases the choice of site will have to be limited only to those sites where such projects may be permitted.

Overall Evaluation There are too many factors to be considered in the selection of a site. Some of these are technical, some legal, but most may be considered as economic factors.

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So if the basic conditions are met, potential sites may be evaluated on economic considerations and the decision may be taken in favour of the most economically viable site.

Two items of costs will be involved in this evaluation, of which one will be incurred only once during the construction of the plant, the other will be a recurring expense to be incurred throughout the life of the plant. Since the expenditures are being incurred at different points of time, and money has a time-bound value, it is necessary for the purpose of economic evaluation to account all the future expenditures at a discount rate to assess their present value. The one with the least present value will, of course, be the choice.

This method of treating future cash flows to assess their present worth is known as *discounted cash flow method*. There are several variants of this method, but all of them yield virtually equivalent results. We will discuss these techniques in detail while dealing with the economic analysis of the entire project.

There is, however, some difficulty in making an economic evaluation of this kind. Enough information is not likely to be available in order to estimate the expenditure to be incurred on the various items. Where cost information is not available or impracticable, due weightage may be given to each factor on 0–100 scale and evaluation of candidate sites made on point basis.

FINANCING ARRANGEMENTS

For the zero date of the project to become effective, it is essential that funds required for the project are arranged. The fund requirement for a project is to meet the capital expenditure for purchasing plant and machinery, initial working capital and pre-operating expenses. Though the entire fund is not required on the zero date, nevertheless, suitable arrangement will have to be made in advance so that funds do not pose a constraint for meeting the project targets once the project starts.

To be able to assess correctly the fund requirement and plan for the same, the first step would be to identify what are the various capital, working and operating costs that are to be financed for a project. Decisions will have to be taken thereafter about the financial structure of the project identifying the portion of debt and equity of the total investment. Only thereafter the various financial institutions can be approached for funding the project.

Capital Costs

All the costs incurred in the project before it becomes ready to start commercial production will be treated as *capital costs*. Therefore, capital cost will include not only expenditure on assets such as land, plant and machinery, township, etc. but also software costs such as design engineering, licensor's fee, management and supervision and even pre-operative expenses. Table 2.1 lists the items which are normally to be included as per the Planning Commission's guidelines for estimating capital cost of a project.

The list of items included in Table 2.1 is only indicative; it will change from project to project. Summation of the capital cost of all the items, working capital and operating costs will establish the total fund required for the project.

The total fund will be required only in phases as per requirement of the project schedule. As the project time schedule may not have all the items of expenditure, a separate time schedule may have to be developed for ascertaining the requirement of funds for each of

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TABLE 2.1 Fund Plan

Item Description	*Total cost (Rs)*	*Plan of Expenditure*					
		J	*F*	*M*	*A*	*M*	*J*
6.0 Engineering and project management							
6.1 Lumpsum payment for technology							
6.2 Engineering fee							
6.3 Management and supervision during construction							
6.4 Enabling works							
6.5 Construction equipment used							
6.6 Commissioning expenditure							
7.0 Misc. fixed assets							
8.0 Preliminary and pre-operative expenses							
9.0 Provision for contingencies							
10.0 Margin money for working capital							
(b) Working capital							
(c) Operating costs							

the items against a time-scale. Table 2.1 shows also the schedule for phasing the capital expenditure. This composite document covering capital expenditure, working capital and operating expenses as also the schedule can be termed as fund plan. This document will prove quite useful for financing of funds and should, therefore, be ready in time for an effective start of the project.

Working Capital

The fund required for maintaining various inventories in the form of raw materials, operating supplies, intermediate products, finished products and meeting miscellaneous cash requirements for maintenance of a level of production is treated as *working capital*. This is not the same as operating expenses as these inventories will be required to be maintained throughout the production life as if there is no consumption. Consumption will be replenished and those expenses will be treated as operating expenses.

A part of working capital, till the plant goes into full production, can be borrowed from the bank against hypothecation of raw materials and operating supplies inventory. This is termed as *borrowed working capital*. The rest of the initial working capital which is financed from long-term sources is treated as *margin*. Margin working capital can be obtained along with funds from sources which finance for capital items. Usually 20–30% of the initial working capital requirement is provided for as margin money in estimating the project cost.

Operating Costs

These are the costs which will be incurred on a recurring basis for production, maintenance and marketing. Raw material, labour, utilities, repair and maintenance, selling expenses and any other expenses to be incurred year after year once the project goes into commercial production are treated as *operating expenses*. These costs are estimated for each year on the assumption of the plant's production level. Operating cost will also include interest on loans

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taken for financing the project. While operating costs will be considered for assessing the economic viability of a project, only a part of it is likely to be financed from long-term sources.

The part of the operating expense which can be financed from long-term sources is termed as *pre-operative expenses*. These include expenses like staff recruitment and training expenses, interest burden and commitment charges, establishment expenses and other similar expenses incurred before the commencement of commercial production.

Source of Financing

There are basically two sources available for financing the fund requirements of a project—internal sources and external sources. Unless a project is very small, the fund requirement will have to be financed from external sources. Table 2.2 details the available sources of financing and also the expenditures that can be financed from these sources. As can be seen from the table, capital cost of the project will require to be financed basically through equity and long-term debts. What needs to be decided now is what portion of the total funds should be from equity and what should be from long-term debt. In other words, the financial structure needs to be decided.

TABLE 2.2 Sources of financing

Terms for Finance	*Source*	*Expenditure to be Financed*
Short-term financing	Trade credit Loan from commercial banks Commercial paper (Hundi) Accounts receivable financing	Working capital
Intermediate-term financing	Term loans Hire purchase Lease financing Fixed deposits from public Central Govt. subsidy	Capital cost
Long-term financing	Common stock Debt Preferred stock	Capital cost

Financial Structure

For the entrepreneur, debt capital is cheaper as compared to equity. This is because interest on debt is tax deductible, whereas dividends on equity are paid out of net income after taxes. But debt capital has fixed liabilities in the sense that if creditors are not paid on time, they can take legal action to realize payment. In extreme cases this can force the company into bankruptcy. The situation is not so risky with equity capital. The stockholders are to receive dividends at the discretion of the company.

However, the cost of avoiding this risk is very high. If in order to avoid risk the company increases equity, the tax burden will increase thereby reducing the amount of dividend that can oe declared. In the long-run, this will prove expensive as the stockholders may be in a hurry to dispose off their shares. Moreover, for a new company it is difficult to raise equity.

So a balance has to be struck between debt and equity. This is popularly referred to as *debt equity ratio*. A company with a proportion of debt is said to be *high leveraged*. A high leveraged company can make larger profit when the demand is pitched high, but at times of

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recession it will also incur high losses. The ratio cannot be allowed to be based arbitrarily. Keeping this logic in view, the controller of capital issues does not permit debt equity ratio to exceed certain safe values depending on the type of industry. For example, in the case of the cement industry this is limited to 4 : 1.

Financial Institutions

Most projects are primarily financed through debts or term loans. There are several institutions functioning at the all-India level as also at state levels which have been set up not only to finance the projects but also to promote establishment of new projects. Besides there are several foreign financial institutions which provide funds to finance projects in developing countries. These are as under.

National Financial Institutions

1. *Industrial Development Bank of India (IDBI)* This is the principal financial institution of India. It coordinates the activities of other financial institutions, supplements their resources to plan and promote industries.

2. *Industrial Finance Corporation of India (IFCI)* It provides long-term loans under various schemes to industrial concerns both in the public and the private sectors.

3. *Industrial Credit and Investment Corporation of India (ICICI)* This is a financial institution which is mainly concerned with providing foreign currency loans to industrial concerns in the private sector.

4. *Industrial Reconstruction Corporation of India (IRCI)* It mainly provides soft loans for revival and revitalization of industrial units which are closed down or are facing closure.

5. *State Financial Corporations (SFC)* These institutions provide loans to small and medium industrial units within their respective states. They also grant loans in foreign exchange for import of plant and machinery.

6. *Unit Trust of India (UTI)* This institution mobilizes the savings of the general public and invests them in various industrial units.

7. *Life Insurance Corporation (LIC)* It has now acquired the status of a development financial institution. It provides long-term finances to industrial units.

8. *The Export-Import Bank of India (Exim Bank)* The Exim Bank provides funds for promotion of exports of engineering and capital goods and related services from India. It provides credit to foreign companies and financial institutions for import of Indian capital goods and services.

9. *The State Industrial Development Corporation (SIDC)* The functions of SIDCs are—

(a) Industrial promotion activities such as project identification, preparation of feasibility reports, identifying entrepreneurs and assisting them in project implementation.
(b) Setting-up of industrial projects as sole owners or in the joint sector.
(c) Creation of infra-structural facilities.
(d) Providing term loans.
(e) Acting as agent of State/Central Government in respect of grant of subsidies

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SIDCs, thus, are different from financial institutions in the sense that they provide not only financial assistance but render all-round assistance in putting up an industrial unit.

Foreign Financial Institutions

1. *World Bank* (*International Bank for Reconstruction and Development*) World Bank provides funds to the less developed member countries for building infrastructure. Schools, irrigation dams, power plants, roads, water supply and sewerage, etc. are the specific projects which have been aided by the World Bank.

2. *International Finance Corporation* (*IFC*) It is a subsidiary of the World Bank and provides funds specifically for the private sector.

3. *International Development Association* (*IDA*) This is also a subsidiary of the World Bank. It provides soft loans to under-developed countries.

4 *United Nations Development Programme* (*UNDP*) *and United Nations Industrial Development Organization* (*UNIDO*) These two institutions of the United Nations provide funds to industrial projects throughout the world.

5. *International Monetary Fund* (*IMF*) This is a part of the United Nations. It complements the World Bank's efforts to promote economic growth.

6. *Asian Development Bank* (*ADB*) This is the development bank for the Asian continent. This institution finances infrastructure projects and also new industrial units.

7. *Non-resident Indians* (*NRI*) Non-residents of Indian nationality or origin as well as overseas companies, partnership firms, trusts, societies and other corporate bodies owned directly or indirectly to the extent of atleast 60% can invest in Indian projects. Payment of such investments is made either by fresh remittance from abroad or from non-resident foreign currency accounts in India.

The Financial institutions, however, have stringent appraisal procedures besides various stipulations relating to sanction of funds. Negotiation and signing of loan agreement will take place only when the appraisal is affirmative. The main thrust of their appraisal is, however, on cost-estimates and profitability analysis, though commercial and technical aspects also receive considerable attention. We will, therefore, discuss these two areas before concluding our discussion on the updating of the feasibility report.

PREPARATION OF COST ESTIMATES

A project cost estimate is required not only for assessing fund requirement but also for ascertaining the economic viability of the project. The estimate should be accurate. If the cost of the project is not estimated accurately the fund plan will consequently be inaccurate. The unit in such a case will face acute shortage of funds and this may lead to the suspension of the project or at least considerable delay. Delay, in turn, will increase the overall cost of the project rendering it economically less viable or even sick.

If, on the other hand, the project cost is overestimated, the project may fail to receive the green signal due to its lower profitability in comparison to other competitive projects. Besides if excessive funds are committed to any project due to over-estimate, several other needy projects will be unnecessarily deprived of funds. An accurate estimate is, therefore, essential not only for getting a project cleared but also to ensure adequate profitability.

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But accuracy in a project is not easy to ensure because of the non-availability of the required information. The information in a project, as we have discussed in Chapter One, gets developed only successively, but a cost estimate is required even on the first day of the project at least to assess the magnitude of the investment involved. Since full information on a project for accurate estimate can be obtained only on completion of the project, one has to make

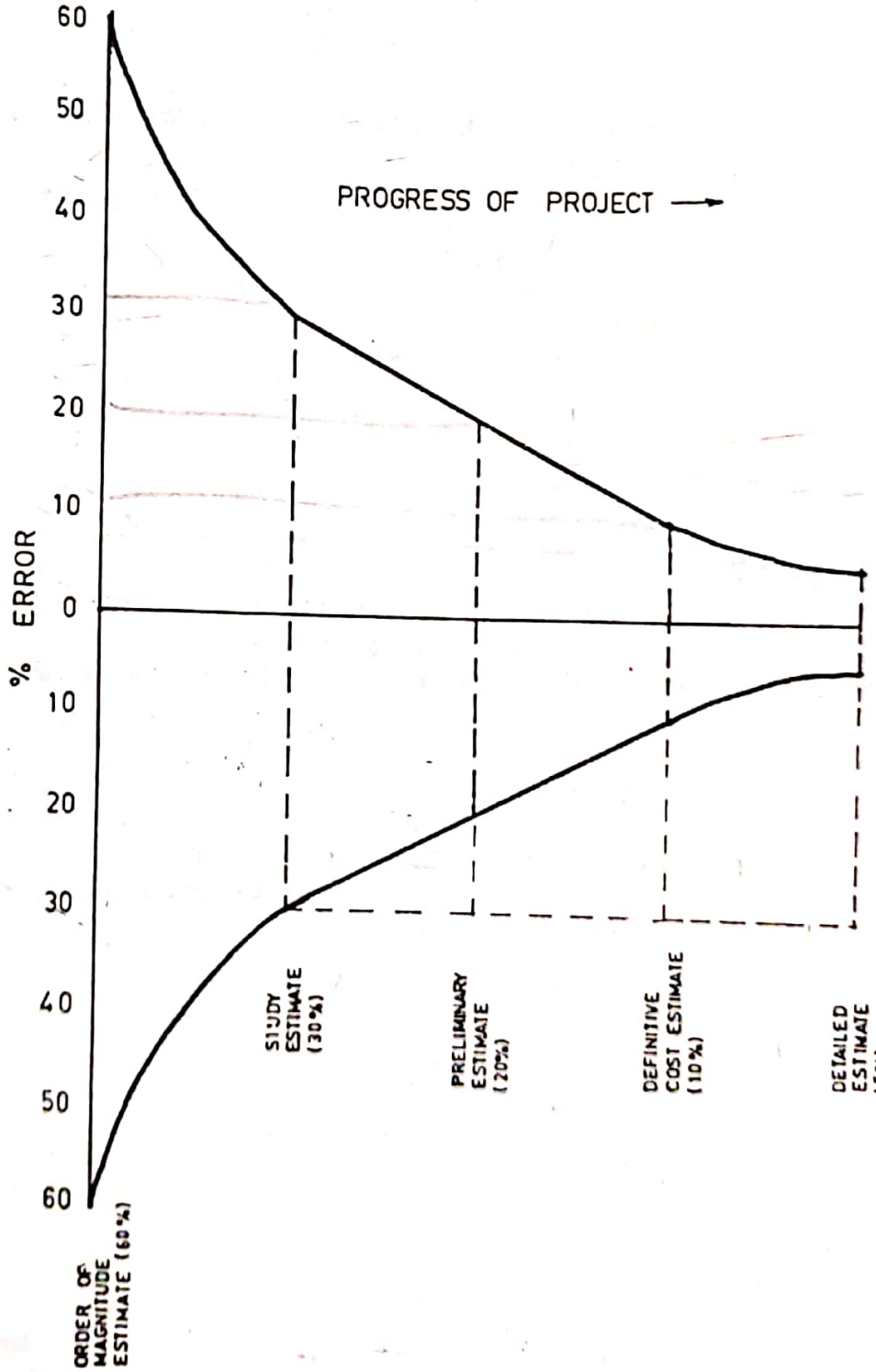

FIG. 2.1 Various types of estimates

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repeated estimates at different stages of the project life-cycle so that a workable estimate with reasonable accuracy is available for the purpose for which the estimate is required. Figure 2.1 shows the various types of estimates that are made during the life-cycle of a project with probable errors.

Types of Estimates

There are roughly five types of estimates that are made during the life-cycle of a project. These are:

1. Order of magnitude estimate
2. Study estimate
3. Preliminary estimate
4. Definitive estimate
5. Detailed estimate

As these estimates have different accuracies depending on information availability, they are accordingly put to different uses. We shall, therefore, discuss these estimates in some detail in the context of their usage.

Order of Magnitude Estimate This estimate is made when a project has been identified and the entrepreneur wants to get a rough idea of the investment so as to decide whether to pursue the project or not. At this stage the entrepreneur knows the description of the product and the capacity of the plant for production of the same. Even with this information it is possible to prepare an estimate, though it will be inaccurate. At best such an estimate can have an accuracy of $\pm 60\%$. The estimating methods that are used for this purpose are known as *ratio methods*.

There are at least five variants of this method. Each of these can provide a fast estimate, but use of one or the other will depend on previous experience on similar plants within the country or elsewhere. The various ratios that are used in this method are:

1. *Investment per annual tonne capacity*: If installed cost of plant P_1 of annual capacity C_1 tonne is rupees R_1 then installed cost R_2 of plant P_2 having annual capacity C_2 can be estimated as

$$R_2 = \frac{R_1 \times C_2}{C_1}$$

The method assumes that the cost of plant per annual tonne capacity for a particular type of industry will hold true for all capacities if the technology remains the same. If the technology is different, or the ratio is not available for the type of plant under consideration, the same may have to be estimated by comparison with the plants of similar complexity for which data are available.

2. *Turn-over ratio and capital ratio*: The ratio between annual sales and investment expressed in rupees is known as *turn-over ratio*. The reverse of this, i.e. the ratio between plant investment and annual sales, both again expressed in rupees, is known as *capital ratio*. If the capital ratio relating to a particular process and plant size is C, then for the proposed plant, knowing the sales volume and price, the installed cost R_2 can be estimated as shown below:

$$R_2 = C \times V_1 \times P_1$$

where, V_1 = projected annual sales volume and P_1 is the price per unit of sales volume.

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3. *Six-tenth factor*: This is a modification of the investment per annual tonne capacity method. In this method plant investment is assumed to vary as 0.6 power of the plant size. Thus, estimated cost R_2 for the new plant can be computed as:

$$R_2 = R_1 \times \left(\frac{C_2}{C_1}\right)^{0.6}$$

where, R_1 and C_1 represent cost and capacity of a previously completed plant and C_2 is the capacity of the proposed plant.

4. *Inflation index*: This index can be used to work out an estimate if the capacity for the new unit remains the same as that of one for which installed cost data are available. The index is otherwise used in conjunction with the methods 1– 3 to correct investment figures to current costs.

$$\text{Installed cost (now)} = \text{Installed cost (past)} \times \frac{\text{Cost index (new)}}{\text{Cost index (past)}}$$

The consumer price index as available in the *Reserve Bank of India Bulletin* can be referred for cost indices.

5. *Location index*: Knowing a plant cost in the USA or any other country, the cost of a similar plant in India or any other country can be estimated using this index. The index can be developed if data related to productivity of countries involved are available. This type of data should be readily available with project management companies having international operations.

Ratio methods can produce only crude estimates since they ignore various details that add to the cost of a project. But when the investor is simply studying opportunities, this enables an investor to screen competitive projects quickly. At this stage, there is certainly no requirement for a more accurate estimate.

Study Estimate This estimate is for studying the economic viability of the project and also for arranging funds for the project. At this stage, preliminary flow sheets, listing of major process equipment giving sizes and materials of construction are obtained from the process licensor. Each piece of equipment is costed by using past data or budgetary quotes obtained specifically from the vendors for this purpose. Overall plant cost is estimated by multiplying the total equipment cost by a factor known as *lang factor*. This factor takes care of civil, electrical, piping, instrumentation, insulation and installation costs. The factor, of course, would vary depending on the type of plant and complexity of the processing scheme.

However, for the purpose of fund planning it is necessary to use separate factors to work out independent costs of civil work, electrical, piping, instrumentation, insulation and installation, etc. as these works are taken up at different points of time.

The accuracy of estimate at this stage is about $\pm$ 30%. Since a project is approved with this estimate, the project authorities count cost over-run on this estimate. However, the actual cost can over-run this estimate by 30%. As per current government guidelines, a public sector project would require fresh approval, if cost over-run exceeds 20%. It appears that with this guideline a public sector project will have to seek fresh approval in view of the inherent inaccuracy of the estimating process alone.

Over-run, if not controlled, will be higher because of unexpected escalation in cost of material and labour during construction, and also due to schedule slippage. The financial

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institutions may sanction escalation cost easily, but an entrepreneur will find it hard to mobilise the additional funds that may be required due to the sheer inaccuracy of the estimate.

Preliminary Estimate There is an urgent need to improve accuracy of cost estimates. Keeping this requirement in view, cost estimates are made successively whenever adequate information, which will ensure further accuracy, is available. The *preliminary estimate* is prepared when the technology package is frozen and a firm implementation schedule is available. This is a significant development in the life of a project. This point of time is considered as an effective start date or *zero date* of the project since it is at this stage that the estimate can be made with acceptable accuracy.

It is at this stage that budget allocation is frozen and a basis of control is established. The accuracy even at this stage is about $\pm 20\%$ which means that even if a project is managed well cost can be overrun by 20%.

At this point we would like to draw the reader's attention to Fig. 2.2 which depicts successive estimates and the associated errors. The diagram may be biased in the sense that it shows that with each successive estimate the average capital cost estimate is increasing and not decreasing. We have kept it this way because in real life estimates made with lesser

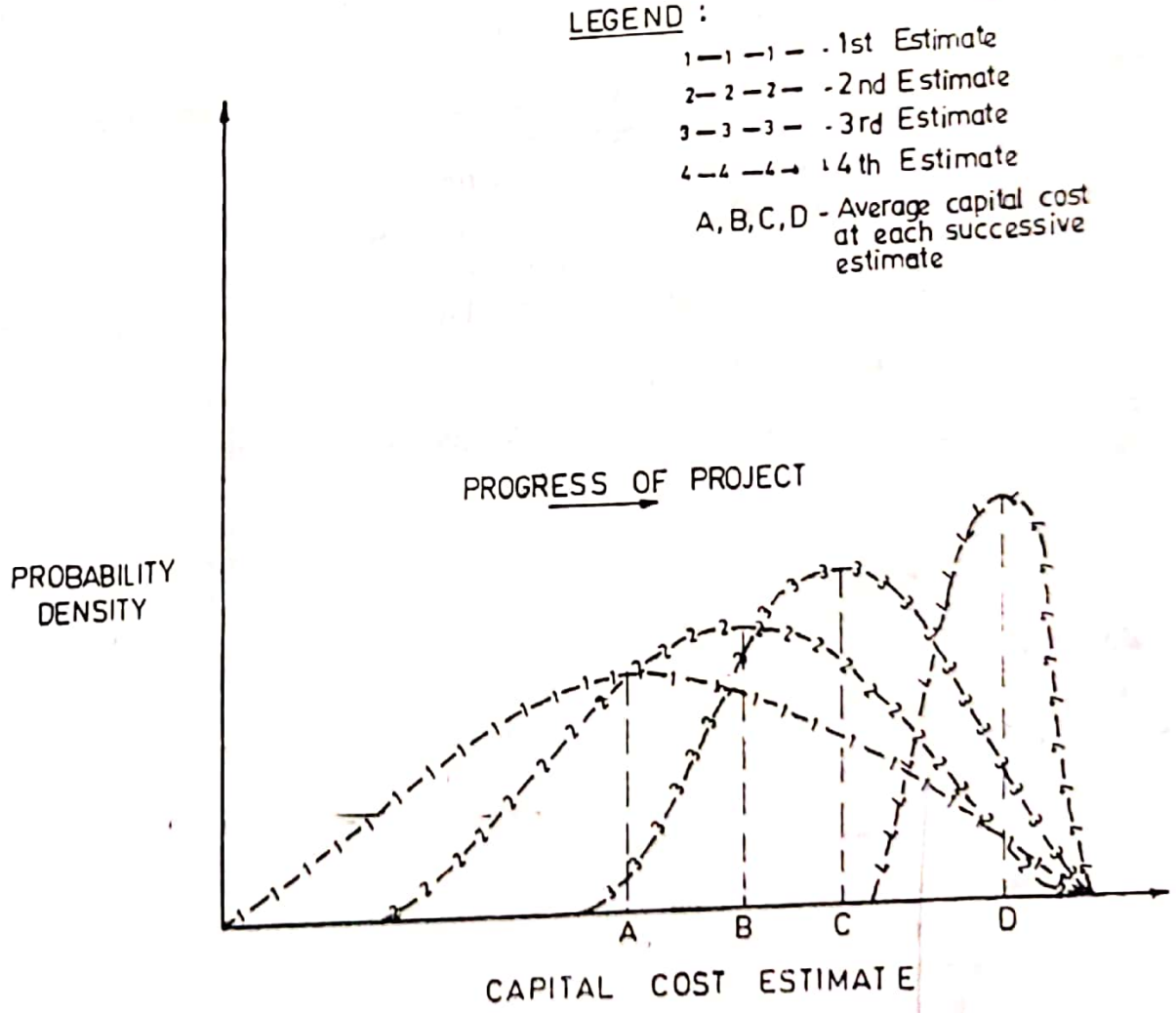

FIG. 2.2 Successive capital cost estimate

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information invariably result in lower capital cost estimate for a project. What we intend to conclude from the diagram is that the project cost target which a project manager could be expected to achieve will vary as the project progresses towards completion. This is natural with any project. There is no point in trying to manage a project with old estimates since as per the law of nature we can control a process only around its central tendency.

The preliminary estimate is based on the final technology package. At this stage, for a chemical process plant, we shall have the following information which adds to the accuracy of estimates:

1. Final process and instrumentation diagram
2. Overall plot plan
3. Preliminary equipment/building layout
4. Final equipment process specifications/data sheets
5. Preliminary single line diagram
6. Preliminary motor list
7. Preliminary piping MTO
8. Final instrument list and spec

When the study estimate was made we did not have all the above information. The estimate based on this information will necessarily have higher accuracy.

Definitive Cost Estimate This estimate is prepared after the zero date when the detailed engineering of a project is in an advanced stage. At this stage the following additional information which will add further accuracy to the estimate are likely to be available:

1. Equipment purchase specifications/vendor quotations/awarded cost.
2. Schedule of items for works tenders/contractor's quotes/awarded cost.
3. Reasonably accurate material take-offs for steel, piping and electrical equipment based on general arrangement drawings.
4. House general arrangement drawings.

The estimate may have an accuracy of ±10%. A typical definitive cost estimate is shown in Table 2.3.

Detailed Estimate This estimate may be made on completion of engineering, ordering of equipment and machinery and award of major field contracts. At this stage head office work for a project is mostly complete. The additional information available at this stage which will add further accuracy to the estimate is:

1. Ordered value of plant equipment and machinery
2. Awarded cost of all major contracts
3. Final material take-offs
4. Ninety per cent construction drawings

The estimate at this stage may have an accuracy of ±5%. It cannot be more accurate since it cannot cover the construction phase. As the reader may have already concluded, 100% accurate estimate cannot be made till the completion of the project. As a matter of fact, 100% accurate estimate can be obtained only when the project goes into full commercial production.

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TABLE 2.3 A typical definitive cost estimate

S. No.	Expense head	Rs. lakhs	Sub-total Rs lakhs
1.0	Land and site development		46.31
1.1	Cost of land	15.00	
1.2	Site grading	15.71	
1.3	Roads and drains	2.00	
1.4	Compound wall	13.60	
2.0	Water supply to plants		109.84
2.1	Water supply from river to battery limit and treatment plant	100.48	
2.2	Overhead tank	9.36	
3.0	Power supply to plants		47.10
3.1	Power supply from SEB	10.60	
3.2	Switch yard	29.50	
3.3	Sub-station building	4.00	
3.4	Street lighting	3.00	
4.0	Non-plant buildings		73.29
4.1	Administration building	3.60	
4.2	Central laboratory	11.40	
4.3	Canteen	7.00	
4.4	Dispensary	3.60	
4.5	Rest room	3.00	
4.6	Central stores	6.25	
4.7	Workshop	4.52	
4.8	Shed for DG sets	2.00	
4.9	Raw material stores	13.60	
4.10	Finished product store	12.00	
4.11	Gate house and time office	1.20	
4.12	Civil maintenance office	3.20	
4.13	Cycle shed	0.52	
4.14	Scale room	1.40	
5.0	Office-site facilities		13.39
5.1	Fork lift truck	2.28	
5.2	Canteen facilities	1.30	
5.3	Dispensary equipment	1.00	
5.4	Time clocking system	0.50	
5.5	Weigh bridge	4.36	
5.6	Telephone and intercom	3.95	
6.0	Utility piping		7.38
6.1	Steam piping	4.88	
6.2	Water piping	2.50	
7.0	Township		98.92
7.1	Cost of land	5.00	
7.2	Site grading, roads, drainage, sewerage, etc.	13.40	
7.3	Power supply and distribution	15.00	
7.4	Water supply	11.52	
7.5	Fencing	1.00	
7.6	Quarters	53.00	
8.0	Plant and machinery		833.75
8.1	Main plant machinery including spares	769.44	

(Contd.)

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